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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/020,813	12/12/2001	Srinivasan Chakravarthi	TI-33161	8922

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EXAMINER
HUYNH, YENNHU B

ART UNIT	PAPER NUMBER
2813	12

DATE MAILED: 08/01/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/020,813	Applicant(s) CHAKRAVARTHI ET AL.	
	Examiner Yennhu B Huynh	Art Unit 2813	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *05 June 2003* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-7* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-7* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

This Office Action is in response to the Appeal Brief filed on 6/5/03.

In view of the Appeal Brief filed on 6/5/03, PROSECUTION IS HEREBY REOPENED. Application set forth below.

To avoid abandonment of the application, appellant must exercise one of the following two options:

(1) File a reply under 37 CFR 1.111 (if this Office action is non-final) or a reply under 37 CFR 1.113 (if this Office action is final); or,

(2) Request reinstatement of the appeal.

If reinstatement of the appeal is requested, such request must be accompanied by a supplemental appeal brief, but no new amendments, affidavits (37 CFR 1.130, 1.131 or 1.132) or other evidence are permitted. See 37 CFR 1.193(b)(2).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-3 are rejected under 35 U.S.C. 103(a) as being unpatentable over Economikos et al (U.S. 6,057,216) in view of Tsunashima (U.S. 5,324,686), and Lee (U.S. 5,773,337).

Economikos et al. disclose a diffusion process for dopant concentration enhancement, which include:

-Re. claims 1-3: forming a coating comprising a dopant oxide glass over a surface of a single crystal silicon semiconductor substrate 1 (col.2 & 3, lines 66-3); heating the semiconductor substrate to cause a portion of the dopant to diffuse from the coating into the semiconductor substrate and thereby form a P-N junction within the semiconductor substrate (col.3, lines 4-12).

However, Econimikos et al. do not disclose wherein the semiconductor substrate comprising an interstitial form and fluorine impurity atom.

Tsunashima discloses a method of manufacturing semiconductor device having a solid phase diffusion source to diffuse the dopant into the substrate, which include semiconductor substrate comprising an amorphous (interstitial) form (col. 11, lines 52-58); and impurity atom hydrogen or fluorine (col.5, lines 25-43, fig.8 and col. 11, lines 13-47).

Lee disclose a method for forming ultra shallow junction of semiconductor device, which also include a substrate comprising has interstitial form (col.3, lines 12).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the Economikos et al. invention by incorporating an impurity atom in the substrate to control substance diffusion.

Econimikos et al. also do not disclose wherein the impurity atom has a dose of about $1x10^{13}$ atoms/$cm^{2,}$ and prior heating at a dose of about $1x10^{14}$ atoms/cm^2; and at 1000^0 C the impurity atom is a faster diffusing species to silicon atoms.

Tsunashima do not disclose an impurity atom has a dose of about $1x10^{13}$ atoms/cm^2 and prior heating at a dose of about $1x10^{14}$ atoms/cm^2, but Tsunashima discloses an impurity atom at a dose at $5x10^{15}cm^{-2}$ in the semiconductor substrate 1 (fig.8 and col. 13-47), and at 900^0 C the impurity atom is a faster diffusing species to silicon atoms (col. 11, lines 18-32).

The average of dopant dosage and temperature are considered to involve routine optimization while has been held to be within the level of ordinary skill in the art, As noted In re Aller 105 USPQ233, 255 (CCPA 1955)., the selection of reaction parameters such as temperature and concentration would have been obvious.

"Normally, it is to expected that a change in temperature, or in range, concentration, cycles, thickness, would be an unpatentable modification. Under some circumstance, however, changes such as these may be impart patentability to a process if the particular ranges claimed produce a new and unexpected result which is different in kind and not merely degree from the results of the prior art ... such ranges are termed "critical ranges and the applicant has the burden of proving such criticality ... More particularly, where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation." In re Aller 105 USPQ233, 255 (CCPA 1955). See also In re Waite 77 USPQ 586 (CCPA 1948); In re Scherl 70 USPQ 204 (CCPA 1946); In re Irmscher 66 USPQ 314 (CCPA 1945); In re Norman 66 USPQ 308 USPQ 308 (CCPA 1945); In re Swenson 56 USPQ 372 (CPA 1942); In re Sola 25 USPQ 433 (CCPA 1935); In re Dreyfus 24 USPQ 52 (CCPA 1934).

Economikos et al. also disclose:

-Re. claim 5: wherein the dopant is boron (col.8, claim 16).

-Re. claim 6: after heating the concentration of the dopant within the substrate is at least about $1x10^{19}$ atom/cm^3 (col.5, lines 25-56).

-Re. claim 7: wherein the coating comprising a silicate glass (col.7, claim 3).

Economikos et al. also do not disclose wherein the dopant diffused into the semiconductor substrate is located about 50 Angstroms from the surface of the semiconductor substrate (cl.4).

-Re. claim 4: Economikos et al. disclose wherein the dopant diffused into the semiconductor substrate is located about 140-200 nm from the surface of the semiconductor substrate.

The range of distance or location of the diffusion region in the semiconductor substrate is depend on the dopant concentration or temperature which are considered to involve routine optimization while has been held to be within the level of ordinary skill in the art, As noted In re Aller 105 USPQ233, 255 (CCPA 1955)., the selection of reaction parameters such as temperature and concentration would have been obvious.

"Normally, it is to expected that a change in temperature, or in range, concentration, cycles, thickness, would be an unpatentable modification. Under some circumstance, however, changes such as these may be impart patentability to a process if the particular ranges claimed produce a new and unexpected result which is different in kind and not merely degree from the results of the prior art ... such ranges are termed "critical ranges and the applicant has the burden of proving such criticality ... More particularly, where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation." In re Aller 105 USPQ233, 255 (CCPA 1955). See also In re Waite 77 USPQ 586 (CCPA 1948); In re Scherl 70 USPQ 204 (CCPA 1946); In re Irmscher 66 USPQ 314 (CCPA 1945); In re Norman 66 USPQ 308 USPQ 308 (CCPA 1945); In re Swenson 56 USPQ 372 (CPA 1942); In re Sola 25 USPQ 433 (CCPA 1935); In re Dreyfus 24 USPQ 52 (CCPA 1934).

Pertinent Prior Art

Toshihiro (JP 3135030A) disclose a semiconductor device and manufacturing. The process include a single crystal semiconductor substrate 2, dopant to form PN

junction in the substrate, and an impurity fluorine in the semiconductor substrate to reduce the number of free bonds and increase current. This reference is deemed to relevant to the current invention.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Yennhu B Huynh whose telephone number is 703-308-6110. The examiner can normally be reached on 8.30AM-7.00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead, Jr., can be reached on 703-308-4940. The fax phone numbers for the organization where this application or proceeding is assigned are 703-308-7722 for regular communications and 703-308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-7724.

YNBH,
7/4/03

CARL WHITEHEAD, JR.
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800